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# Wind Speed Ensemble Predictions with an Analog-based Method in Complex Terrain

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The first step to build an analog ensemble (AnEn) method is the search for similar (i.e. analogs) past predictions across several variables (e.g., wind speed, wind direction, temperature) to the current prediction. Then, the measurements corresponding to the analogs form the AnEn. The AnEn can be used to generate both deterministic (e.g., the AnEn mean or median) and probabilistic short- or medium-range forecasts. It provides accurate predictions while reliably quantifying their uncertainty.

The AnEn was generated by Aire Limitée Adaptation dynamique Développement InterNational model (ALADIN) run over two nested domain with 8 and 2 km horizontal resolution, respectively. It was tested at several climatologically different locations across Croatia for point-based wind speed predictions at 10 m height. Results were verified and compared to ALADIN model to address the following question: what is the impact of the ALADIN model resolution on the performance of the AnEn? The verification procedure includes several metrics computed considering wind speed as continuous, categorical and probabilistic predictand, to optimize the AnEn configuration, and to test both the deterministic and probabilistic prediction performances.

This study shows that deterministic AnEn predictions, compared to model used to generate it, improve linear correlation between predictions and measurements and reduce bias and root-mean-square error, especially in complex terrain. Besides, probabilistic AnEn predictions provide reliable information about their uncertainty. Improvement in forecast accuracy brought by computationally cost effective AnEn generated by ALADIN model with 8 km horizontal resolution is comparable to the improvement of higher-resolution output of ALADIN model (2 km). Refinement of ALADIN model horizontal resolution used to generate AnEn additionally improves AnEn predictions. Thus, optimal chain of different components in the weather prediction systems can successfully be broaden by using deterministic AnEn forecast in assessment of wind power, and probabilistic product in operative purposes at wind farms.